National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Weather Station Maintenance in Southwest Alaska Network Parks

Summary for the 2013 Hydrologic Year

Natural Resource Data Series NPS/SWAN/NRDS—2013/592

ON THE COVER
Bob Peterson installs sensors on a remote automated weather station near Three Forks, Katmai National Park and Preserve
Photograph by: Chuck Lindsay

Weather Station Maintenance in Southwest Alaska Network Parks

Summary for the 2012 Hydrologic Year

Natural Resource Data Series NPS/SWAN/NRDS—2013/592

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National Park Service
Natural Resource Stewardship and Science
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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols (Lindsay et al. 2012) and were analyzed and interpreted within the guidelines of the protocols.

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Contents

Contents (continued)

Figures

Page

Figures (continued)

Page

Figures (continued)

Page

Figures (continued)

Page

Tables

Page

Abstract

Field maintenance of climate monitoring stations is necessary to provide for the continuous acquisition of quality meteorological data, retrieval of complete station data, and fulfilling the station standards issued by respective climate monitoring programs (e.g. National Wildfire Coordinating Group 2012). In 2013, the Southwest Alaska Network (SWAN) operated and maintained 12 Remote Automated Weather Stations (RAWS) and six time lapse cameras (phenocams) in three network parks. This report summarizes all work (annual maintenance, unscheduled maintenance, station removal, and new installations) for the 2013 hydrologic year (October 1, 2012 to September 30, 2013) and includes up-to-date sensor metadata.

Acknowledgments

Successfully maintaining weather stations in three park units wouldn't have been possible without the cooperation, field assistance, and air support from Alaska Wildland Adventures, Leon Alsworth, Paul Anderson, Wendy Artz, Mike Brandau, Mellisa Elerick, Mike Fell, Allen Gilliland, Vera Gilliland, Kris Holderied, Ginger Irvine, Jared Irvine, Mark Kansteiner, Deb Kurtz, Tyler Lawson, Julie Markus, Mary McBurney, Garth Murdock, Doug Peratrovich, Bob Peterson, Laura Phillips, Port Graham Corporation, Whitney Rapp, Rich Richotte, Jeff Shearer, Cara Staab, and Haley Williams.

List of Acronyms

Ah	Amp hour
AKDST	Alaska Daylight Savings Time
AT-RH	Air Temperature – Relative Humidity
ATV	All Terrain Vehicle
B206	Bell 206 helicopter
CRN	Climate Reference Network
CS	Campbell Scientific
C185	Cessna 185 airplane
C206	Cessna 206 airplane
DLP	Data Logger Program
FTS	Forest Technology Systems
GB	Gigabyte
GOES	Geostationary Operational Environmental Satellite
GPS	Global Positioning System
I&M	Inventory and Monitoring
KATM	Katmai National Park and Preserve
KEFJ	Kenai Fjords National Park
LACL	Lake Clark National Park and Preserve
M/V	Motor Vessel
NESDIS ID	National Environmental Satellite, Data, and Information Service Identifier

List of Acronyms (continued)

NIFC	National Interagency Fire Center
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWCG	National Wildfire Coordinating Group
NWS	National Weather Service
PEPC	Planning, Environment and Public Comment
PV	Photovoltaic
RAWS	Remote Automated Weather Station
RG-TB	Rain Gauge – Tipping Bucket
SD	Snow Depth (weather station sensor) or Secure Data (camera memory storage)
SDI	Serial Digital Interface
SDI-AM	Serial Digital Interface – Analog Module
SR	Solar Radiation
SWAN	Southwest Alaska Network
USFWS	United States Fish and Wildlife Service
V	Volt
W	Watt
WD	Wind Direction
WFMI	Wildland Fire Management Information
WRCC	Western Regional Climate Center
WS	Wind Speed

Weather Station Locations

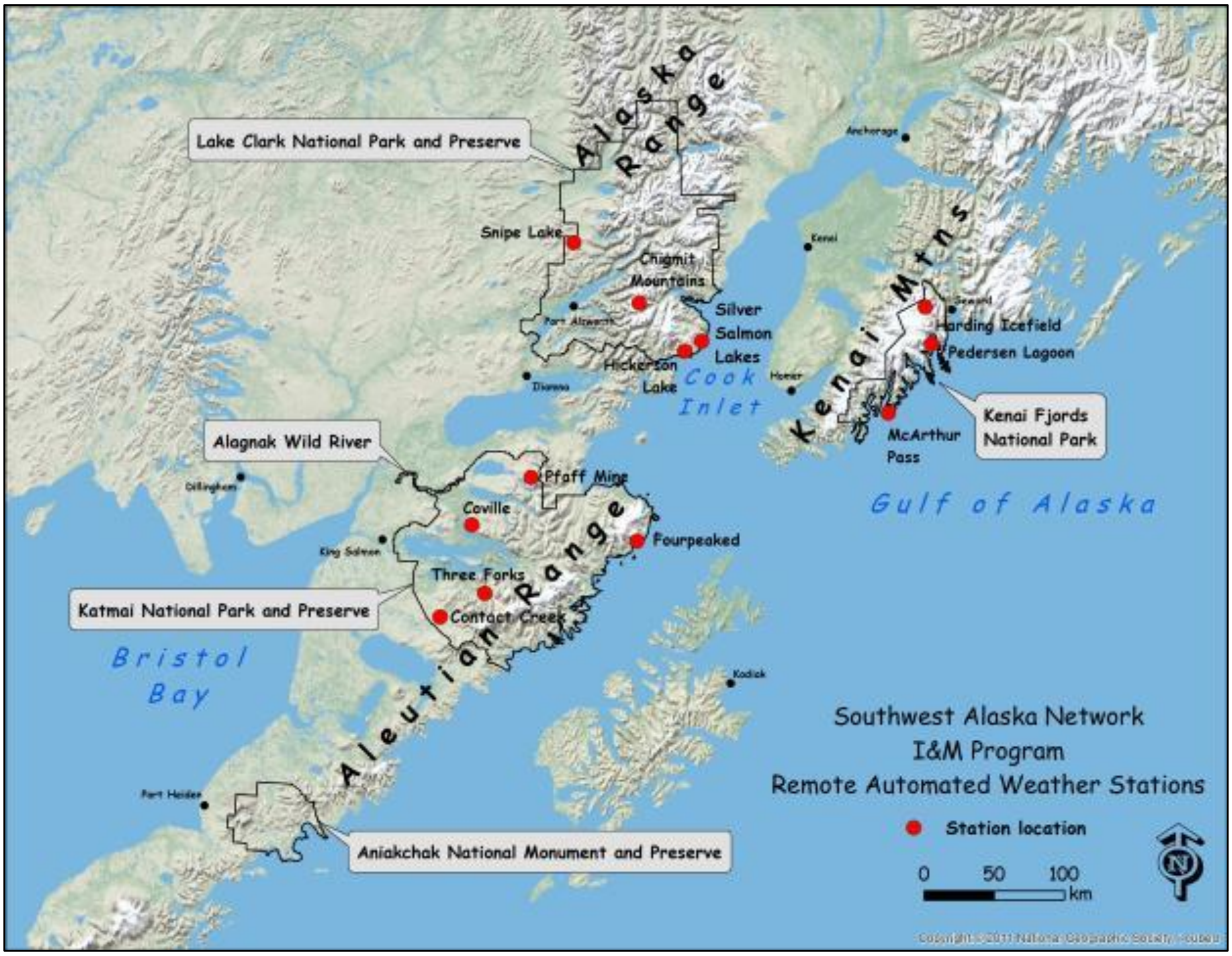

Figure 1. Map showing locations of weather stations operated and maintained by the SWAN.

Table 1. Metadata for weather stations operated and maintained by the SWAN.

Station name	Park	Station type	NESDIS ID no.	Lat. N	Lon. W	Elev ft.	Start date	End date
Chigmit Mountains	LACL	RAWS	FA6544FC	60.2249	153.4675	4658	7/2009	--
Contact Creek	KATM	RAWS	32803738	58.2076	155.9225	657	6/2008	9/2013
Coville	KATM	RAWS	3280B12C	58.8025	155.5629	1567	6/2008	--
Fourpeaked	KATM	RAWS	328135C2	58.7057	153.5179	1074	6/2009	--
Harding Icefield	KEFJ	RAWS	FA656210	60.1325	149.7820	4335	7/2004	--
Hickerson Lake	LACL	RAWS	3280C7BC	59.9148	152.8925	1048	6/2008	T.B.D.
McArthur Pass	KEFJ	RAWS	3280244E	59.4726	150.3337	1266	6/2008	--
Pedersen Lagoon	KEFJ	RAWS	326AD012	59.8944	149.7308	624	8/2011	--
Pfaff Mine	KATM	RAWS	FA65578A	59.1109	154.8367	2018	6/2008	--
Silver Salmon Lakes	LACL	RAWS	32352246	59.9737	152.6713	23	7/2013	--
Snipe Lake	LACL	RAWS	328041A8	60.6103	154.3199	2315	6/2008	--
Three Forks	KATM	RAWS	32803738	58.3678	155.3839	1358	9/2013	--

Weather Station Maintenance Summaries

Chigmit Mountains Weather Station – Annual Maintenance – June 12, 2013

Date: June 12, 2013
Time of visit: 1500-1800
Personnel: Chuck Lindsay, Mike Fell
Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)
Purpose of trip: Annual maintenance
Weather: Mostly sunny, 50 F, winds E 10 mph gusting 15 mph, 0 in snow on the ground

Sensors replaced:
Air temperature – relative humidity
Reinforced 20-ft wind sensor mast
Wind sensor arm
Wind speed and cable
Wind direction and cable
Snow depth (SR50)

Narrative:
Maintenance of Chigmit Mountains weather station was done on the same day as maintenance on Fourpeaked weather station. A round-trip helicopter flight was made from Homer with a refueling stop in Port Alsworth (at Lake and Pen Air). The station had been badly damaged by rime ice (Figures 2 and 3) and the 20-ft wind sensor mast had broken and both wind sensors were wrecked. This mast was replaced with a new one that was reinforced by welding a smaller diameter aluminum pipe inside the mast in order to reinforce the junction which had broken. All guy-wires and associated hardware were also replaced. The AT-RH sensor, WS sensor and cable, WD sensor and cable were replaced. A WD sensor direction test was done. The rain count for the tipping bucket was zeroed, and a tipping bucket test was done. All data in the data logger were downloaded to send to the WRCC in order to update the archive. The SD sensor was replaced with a Campbell Scientific SR50 SD sensor, which was rehabbed with new transducer plates and desiccant. Data logger program CHMO_DLP_SR50.prg was edited to zero the SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. In stark contrast to June of 2012, there was no snow present directly at the station at the time of maintenance. All bolts on the station were checked and tightened if loose and all cables were zip-tied. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°, Figure 4) and the inside of the instrument enclosure (Figure 5) was also photographed.

Figure 2. Chigmit Mountain RAWS – Station photographed on April 2, 2013 showing broken mast.

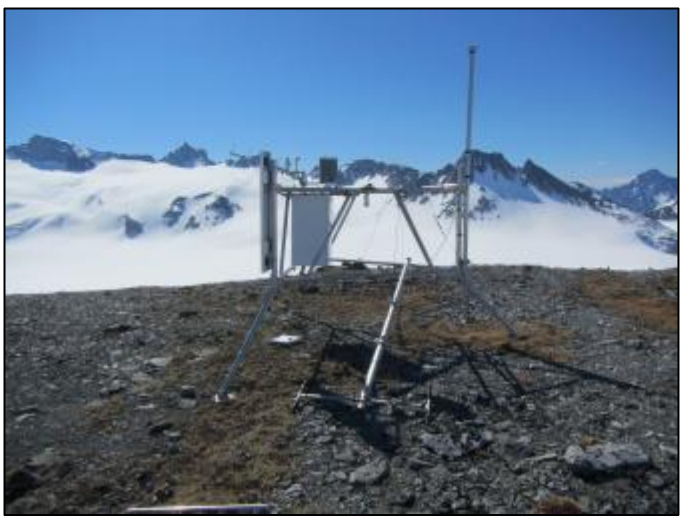

Figure 3. Chigmit Mountain RAWS – Broken mast and wrecked wind sensors.

Figure 4. Chimgit Mountain RAWS – Station after maintenance photographed from southwest.

Figure 5. Chimgit Mountain RAWS – Inside of instrument enclosure photographed before departure.

Contact Creek Weather Station – Annual Maintenance – June 24, 2013

Date: June 24, 2013
Time of visit: 1300-1600
Personnel: Chuck Lindsay, Whitney Rapp
Mode of transport: C185 (on wheels) from King Salmon (park aircraft)
Purpose of trip: Annual maintenance
Weather: Partly cloudy, 58 F, winds W 9 mph gusting 16 mph

Sensors replaced:
Air temperature – relative humidity
Snow depth (SR50A)
Phenocam (Harbotronics) SD card and desiccant
Phenocam (Campbell Scientific) SD card and desiccant; removed battery and PV charge controller

Narrative:
Access to the Contact Creek weather station was by park wheel plane from King Salmon. The station was in good shape. The AT-RH sensor was replaced and the SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which had been rehabbed with new transducer plates and desiccant. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. All data in the data logger were downloaded to send to the WRCC in order to update the archive. Data logger program COCR_DLP_SR50A.prg was edited to zero the SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. All bolts on the station were checked and tightened if loose and all cables were zip-tied. Before departure the station was photographed from eight directions (every 45°; Figure 6). The electric fence that surrounds the Climate Reference Network station and the RAWS was maintained. Upon arrival the gate was found open.

The Harbortronics time lapse camera (Figure 7) was maintained. The 32 GB SD card was exchanged for an empty one and the desiccant packs were replaced. The camera collected four RAW-format photos/day between August 16, 2012 and June 24, 2013. The intervalometer programing was not changed. Before departure a thin film of silicone grease was applied to the gasket on the housing door with an irrigation syringe to help maintain a seal.

Campbell Scientific time lapse cameras were installed at all Phenocam sites in 2012 in order to replace the Harbotronics cameras after a year or so of overlap in operation. The rationale was that this equipment had a better housing that would protect the camera from moisture and that it would also be easier to maintain in the field (graphical instead of command line laptop interface and reduced likelihood of accidentally changing focus and zoom). The newer Campbell Scientific camera was maintained. The 16 GB SD card was exchanged for an empty one and the tiny desiccant packs were replaced. The camera collected 13 JPG-format photos/day between August 1, 2012 and January 19, 2013 when the camera apparently stopped working. Battery voltage was 2 V. It is assumed the camera did not switch into a low power state and therefore drained the battery during winter low-light conditions. The separate 35 Ah battery and charge controller were removed and the camera was directly connected to the two 100 Ah batteries that charge the weather station (Figure 8).

The inside of the instrument enclosure (Figure 9) was also photographed before departure.

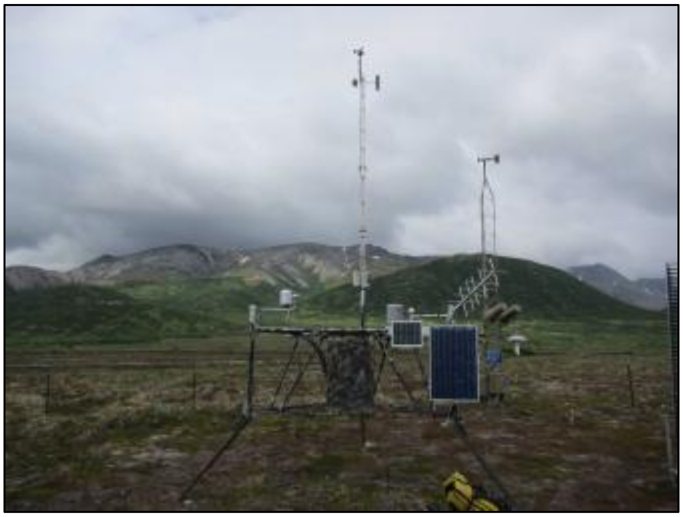

Figure 6. Contact Creek RAWS – Station after maintenance photographed from south. The Climate Reference Network station that was installed in August 2012 is visible in the background.

Figure 7. Contact Creek RAWS – Harbortronics time lapse camera housing visible mounted to wind sensor mast.

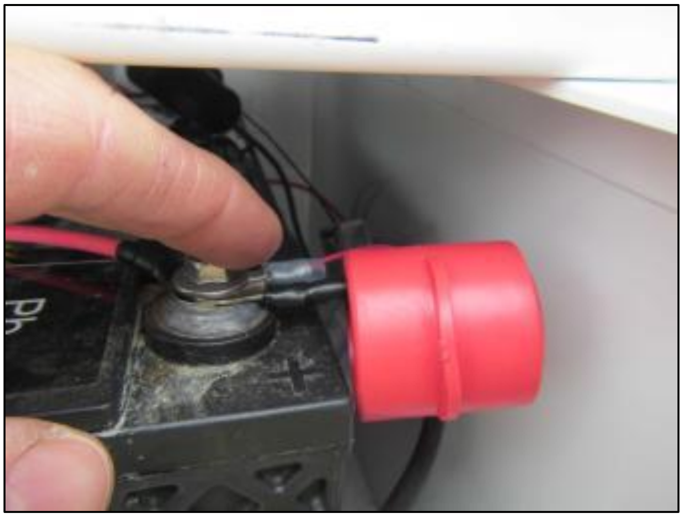

Figure 8. Contact Creek RAWS – Campbell Scientific time lapse camera was directly powered off the 100 Ah batteries. Note thin red wire from positive battery terminal to the camera cable.

Figure 9. Contact Creek RAWS – The inside of instrument enclosure photographed before departure. Note Campbell Scientific power cable with white labeling leading toward 100 Ah batteries.

Contact Creek Weather Station – Station Removal – September 3, 2013
Date: September 3, 2013
Time of visit: 1100-1800
Personnel: Chuck Lindsay, Whitney Rapp
Mode of transport: C185 (on wheels) from King Salmon (park aircraft), B206 helicopter from King Salmon (Egli Air Haul)
Purpose of trip: Remove station, move time lapse camera to Climate Reference Network station
Weather: Cloudy, 50 F, winds SE 9 mph gusting 20 mph

Narrative:
The National Oceanic and Atmospheric Administration (NOAA) installed a Climate Reference Network (CRN) station at Contact Creek in August 2012. As planned, both the CRN station and the Contact Creek RAWS overlapped in operation for one year. In accordance with environmental planning and compliance documents, the Contact Creek RAWS was disassembled and packaged for transport to Three Forks (25 miles to the northeast). Egli Air Haul slung the weather station frame, instrument enclosure and batteries to Three Forks (Figure 10) and the remaining components were taken to King Salmon aboard the fixed-wing aircraft.

Although the new station (called Three Forks, Alaska) uses the same equipment and NESDIS ID number as the Contact Creek RAWS, it will be considered a new station and receive a new NWS location identifier and new station pages on the internet.

The Harbortronics time lapse camera was moved to the CRN solar panel array. The 32 GB SD card was exchanged for an empty one and the desiccant packs were replaced. The camera collected four RAW-format photos/day between June 25, 2013 and September 3, 2013. The intervalometer programing was reprogrammed with the same parameters. Before departure a thin film of silicone grease was applied to the gasket on the housing door with an irrigation syringe to help maintain a seal. The camera was connected to a 100 Ah battery, solar charge regulator, and 10 W solar panel that were attached to, or stored within, the CRN battery enclosure. The new field of view for the camera is shown in Figure 11. It was intended to match the old field of view as much as possible.

The newer Campbell Scientific time lapse camera was removed. The 16 GB SD card was retrieved; however the camera did not collect any photographs between June 25, 2013 and September 3, 2013. It is unclear what went wrong. The camera was brought back to the office and will be returned to the manufacturer for inspection.

Figure 10. Contact Creek RAWS – Egli Air Haul helicopter slings the weather station tower to Three Forks.

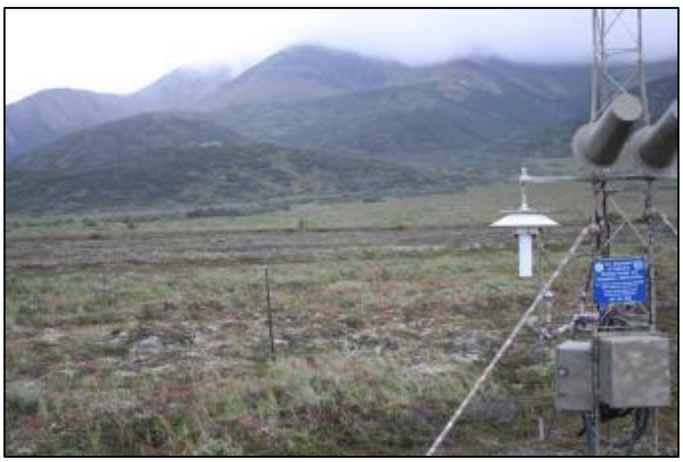

Figure 11. Contact Creek RAWS – Field of view for Harbortronics time lapse camera after being moved to Climate Reference Network station.

Coville Weather Station – Annual Maintenance – June 25, 2013

Date: June 25, 2013
Time of visit: 1300-1700
Personnel: Chuck Lindsay, Whitney Rapp
Mode of transport: Found Bush Hawk (on floats) from King Salmon (USFWS aircraft)
Purpose of trip: Annual maintenance
Weather: Mostly sunny, 68 F, winds NW 7 mph gusting 16 mph

Sensors replaced:
Air temperature – relative humidity
Snow depth (SR50A)
Solar radiation
SDI expansion port
Phenocam (Harbotronics) SD card and desiccant
Phenocam (Campbell Scientific) SD card and desiccant; removed battery and PV charge controller

Narrative:
Access to the Coville weather station was by USFWS float plane (NPS pilot) from King Salmon (Figure 12). The station was in great shape. The AT-RH sensor was replaced and the SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which had been rehabbed with new transducer plates and desiccant. The SR sensor was replaced because there had been some anomalous data spikes during spring. The SDI expansion port was also replaced because it wasn't clear if the expansion port or the SR sensor were causing the problem. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. All data in the data logger were downloaded to send to the WRCC in order to update the archive. Data logger program COVI_DLP_SR50A.prg was edited to zero the SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. All bolts on the station were checked and tightened if loose and all cables were zip-tied. Before departure, the station was photographed from eight directions (every 45°; Figure 13) and the inside of the instrument enclosure was also photographed (Figure 14).

The Harbortronics time lapse camera (Figure 15) was maintained. The 32 GB SD card was exchanged for an empty one and the desiccant packs were replaced. The camera collected four RAW-format photos/day between June 20, 2012 and June 25, 2013. The intervalometer programing was not changed. Before departure a thin film of silicone grease was applied to the gasket on the housing door with an irrigation syringe to help maintain a seal.

The newer Campbell Scientific time lapse camera (Figure 15) was also maintained. The 16 GB SD card was exchanged for an empty one and the tiny desiccant packs were replaced. The camera collected 13 JPG-format photos/day between June 21, 2012 and October 3, 2013 when the camera apparently stopped working. Battery voltage was <2 V. It is assumed the camera did not switch into a low power state and therefore drained the battery during winter low-light conditions. The separate 35

Ah battery and charge controller were removed and the camera was directly connected to the two 100 Ah batteries that charge the weather station (Figure 16).

Figure 12. Coville RAWS – USFWS Found aircraft and NPS pilot Allen Gilliland at the small unnamed lake above Coville Lake. The NPS unofficially refers to this lake as 'Wolverine Lake'.

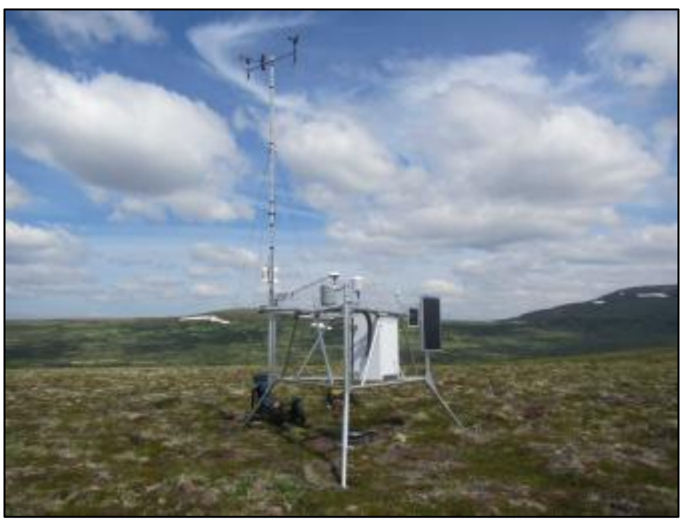

Figure 13. Coville RAWS – Station after maintenance photographed from southwest.

Figure 14. Coville RAWS – Inside of instrument enclosure after maintenance.

Figure 15. Coville RAWS – Harbortronics time lapse camera housing (beige box) mounted to wind sensor mast and Campbell Scientific time lapse camera (foreground).

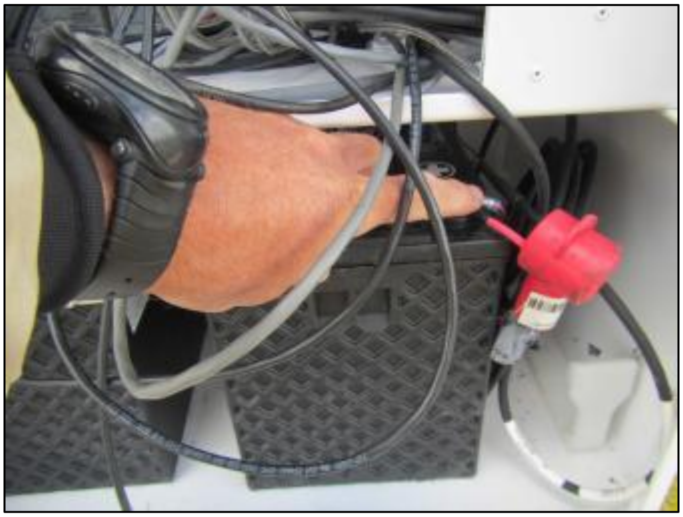

Figure 16. Coville RAWS – Campbell Scientific time lapse camera was directly powered of the 100 Ah batteries. Note thin red wire from positive battery terminal to the camera cable.

Exit Glacier Phenocam – Initial Setup – May 2, 2013

Date: May 2, 2013
Time of visit: 1300-1600
Personnel: Chuck Lindsay, Deb Kurtz
Mode of transport: Snowmachine from Seward, ski from NPS cabin
Purpose of trip: Initial setup
Weather: Cloudy, 35 F, winds light and variable

Sensors installed:
Phenocam (Campbell Scientific) SD card and desiccant
10 W solar panel
Charge controller
35 Ah battery

Narrative:
A Campbell Scientific CC5MPX digital camera was mounted to the equipment shelter at the Exit Glacier SNOTEL site. In order to mount the camera, one inch aluminum pipe was attached to the shelter using speed-rail fittings (Figure 17). The camera was equipped with a 16 GB SD card and programmed to acquire 13 JPG-format photos/day. The camera is powered by a 35 Ah sealed battery that is stored inside the equipment shelter (Figure 18) and a 10 W solar panel.

Figure 17. Exit Glacier phenocam – Campbell Scientific time lapse camera and 10 W solar panel mounted to the equipment shelter at the Exit Glacier SNOTEL.

Figure 18. Exit Glacier phenocam – 35 Ah battery and charge controller inside the equipment shelter at the Exit Glacier SNOTEL.

Exit Glacier Phenocam – Maintenance – August 9, 2013

Date: August 9, 2013
Time of visit: 1300-1500
Personnel: Chuck Lindsay, Deb Kurtz, Julie Markus
Mode of transport: Vehicle from Seward, foot from NPS cabin
Purpose of trip: Maintenance
Weather: Rain, 53 F, winds light and variable

Sensors installed:
Phenocam (Campbell Scientific) swapped SD card and desiccant
10 W solar panel - moved
Charge controller (different)
100 Ah battery

Narrative:
An unscheduled maintenance visit to the Exit Glacier phenocam was made because of the poor performance of the Campbell Scientific CC5MPX cameras at other weather stations. The camera was operating normally. The 16 GB SD card was exchanged for an empty one and the tiny desiccant packs were replaced. The camera collected 13 JPG-format photos/day between May 2, 2012 and August 9, 2013. Battery voltage was good and receiving charge from the solar panel. The solar panel was moved to face south to achieve maximum solar gain during winter months (Figure 19). The battery was replaced with a 100 Ah battery for increased capacity (Figure 20). The solar charge regulator was replaced with a SunSport 6 amp charger manufactured by EcoEnergy (Figure 20). Initially it was thought that solar charge regulator failure was responsible for the failure of the other Campbell Scientific phenocams and that is why the charge controller was replaced. However, correspondence with Campbell Scientific indicates that there are hardware issues with cameras with serial numbers that precede 1200. Apparently these earlier models sometimes fail to switch into a low power or ‘off state’. The Exit Glacier phenocam is the only Campbell Scientific phenocam that SWAN operates with a serial number > 1200.

Figure 19. Exit Glacier phenocam – The solar panel was moved to a higher location and now faces south.

Figure 20. Exit Glacier phenocam – The power supply was changed to incorporate a 100 Ah battery and new charge regulator.

Exit Glacier Phenocam – Maintenance – October 23, 2013

Date: October 23, 2013
Time of visit: 1600-1700
Personnel: Chuck Lindsay, Deb Kurtz, Julie Markus
Mode of transport: Vehicle from Seward, foot from NPS cabin
Purpose of trip: Maintenance
Weather: Sunny, 33 F, winds light and variable

Sensors installed:
Phenocam (Campbell Scientific) swapped SD card and desiccant

Narrative:
The camera was operating normally. The 16 GB SD card was exchanged for an empty one and the tiny desiccant packs (five) were replaced. The camera collected 13 JPG-format photos/day between August 9 and October 23, 2013 (Figure 21).

Figure 21. Exit Glacier phenocam – Time lapse photograph taken on July 27, 2013 showing field of view of the camera.

Fourpeaked Weather Station – Unscheduled Maintenance – October 22, 2012

Date: October 22, 2012
Time of visit: 1100-1400
Personnel: Chuck Lindsay, Mike Brandau
Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)
Purpose of trip: Unscheduled maintenance
Weather: Sunny, 62 F, winds light

Sensors replaced:
Frame
Data logger
GOES transmitter
Power manager
GOES antenna and cable
GPS antenna and cable
Solar radiation

Narrative:
Access to the Fourpeaked weather station was by helicopter from Homer. The station appeared to be in good condition with no visible damage, but it was not working. Station stopped transmitting on September 2, 2012. Upon arrival there were no fault lights indicated on the GOES transmitter. Problems were experienced communicating with the data logger using FTS toolbox. The error message "Error 301: Unable to wake device" was repeatedly received and communications were never established. Thus data was never retrieved. The data logger, GOES transmitter, power manager, GOES antenna (oriented to 159 degrees true and inclination of +16 degrees) and cable, and GPS antenna and cable were all replaced because it wasn't clear which component was faulty. It was clear that the data logger wasn't working, but it wasn't obvious what caused it to fail. This problem was previously experienced on June 16, 2012 and the station was subsequently repaired on July 17, 2012. Due to the cost of accessing this station everything that might have contributed to the problem was replaced. Battery voltage was good and both batteries had been replaced on June 7, 2012 so they were not replaced during this visit. Some corrosion was present on the base of the power manager (Figure 22) and on the GOES antenna where the antenna elements are attached (Figure 23). The solar radiation sensor was also replaced because the sensor had a short cable and, because its cable couldn't be routed properly, it was vulnerable to damage by storms and wildlife. The replacement sensor cable has an armored housing. Station observations and GOES transmission quality were checked before departure with FTS support. Observations and transmissions were verified from the WFMI website by NIFC staff and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°) and the inside of the instrument enclosure (Figure 24) was also photographed.

Figure 22. Fourpeaked RAWS – Corrosion present on base of power manager.

Figure 23. Fourpeaked RAWS – Corrosion present on GOES antenna.

Figure 24. Fourpeaked RAWS – Inside of instrument enclosure after maintenance.

Fourpeaked Weather Station – Annual Maintenance – June 12, 2013

Date: June 12, 2013
Time of visit: 1000-1400
Personnel: Chuck Lindsay, Mike Fell
Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)
Purpose of trip: Annual maintenance
Weather: Sunny, 50 F, winds SW 6 mph gusting 10 mph

Sensors replaced:
Tower panels
Data logger (12S)
GOES transmitter (G5) and antenna cable
Air temperature – relative humidity
Wind speed
Wind direction

Narrative:
A replacement frame (three Tri-Leg Tower panels) was dropped off by helicopter (Pathfinder Aviation) during the week prior to annual maintenance. Because this flight was transporting an external load, passengers were not permitted. Access to the Fourpeaked weather station for maintenance was by helicopter from Homer on the same day as the trip to the Chigmit Mountains weather station. The station was in good condition, although not transmitting. Previous maintenance indicated that there were breaks to the welds on two of the tri-leg tower panels. This detail is important because the GOES satellite antenna coaxial cable was damaged – probably by vibrations at one of the broken welds (Figure 25) caused by wind. For this reason, the station hadn't transmitted since January 2013.

Two of the three tower panels were replaced. A third replacement panel was cached adjacent to the weather station. All guy-wires and associated hardware were replaced. All bolts on the station were replaced and sensor cables were zip-tied to the new frame. The data logger (12S version 6.7), GOES transmitter, GOES antenna cable, AT-RH sensor, WS sensor, WD sensor were replaced. Both wind sensors on this station are replaced each year because of harsh conditions at the site. A WD sensor direction test was done. The rain count for the tipping bucket was zeroed, and a tipping bucket test was done. All data in the data logger (October 10, 2012 to June 12, 2013) were downloaded to send to the WRCC in order to update the archive. Data logger program FOUR_DLP_SR50A.prg was loaded on the replacement data logger and the GOES transmitter was properly configured. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°, Figure 26) and the inside of the instrument enclosure (Figure 27) was also photographed.

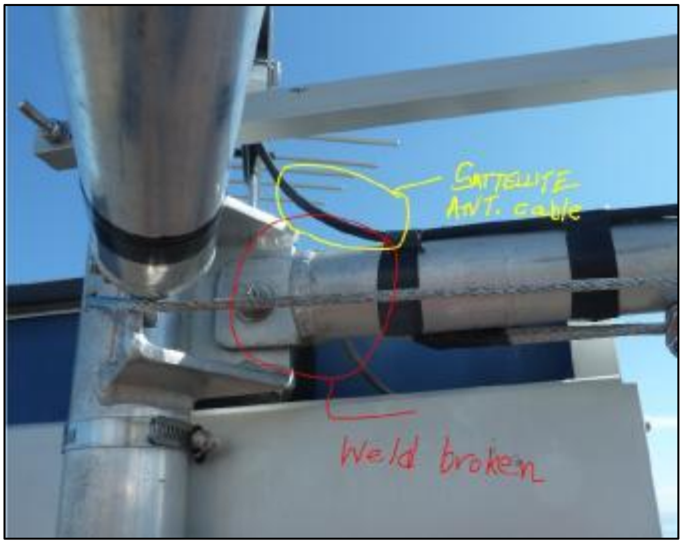

Figure 25. Fourpeaked RAWS – Broken frame weld and damaged GOES satellite antenna cable.

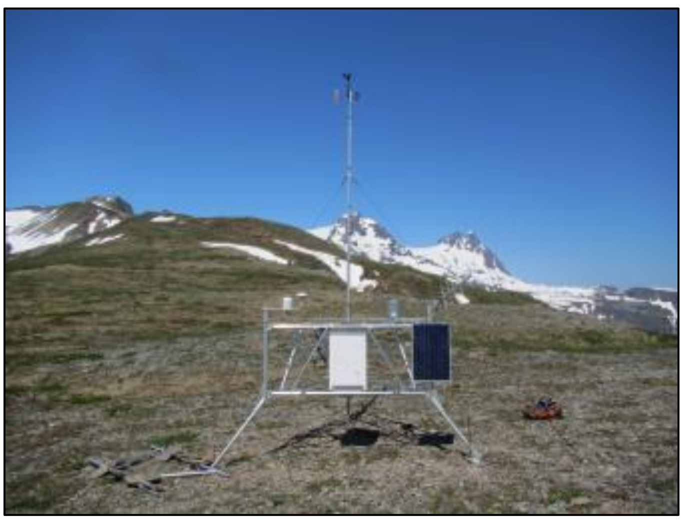

Figure 26. Fourpeaked RAWS – The tower frame panels were replaced and an extra panel was cached.

Figure 27. Fourpeaked RAWS – The inside of the instrument enclosure with new data logger and GOES transmitter.

Harding Icefield Weather Station – Annual Maintenance – April 19, 2013

Date: April 19, 2013
Time of visit: 1100-1600
Personnel: Chuck Lindsay, Haley Williams (Alaska Pacific University volunteer)
Mode of transport: B206 helicopter from Seward (Pathfinder Aviation)
Purpose of trip: Annual maintenance
Weather: Sunny, 28 F, winds light, 11.5” of snow on the ground

Sensors Replaced:
Temperature-Relative Humidity
Wind speed
Wind direction
Snow depth (Judd Communications sensor)
Tipping bucket
Batteries (two at 100 Ah)

Narrative:
Access was by helicopter from Seward. This work took place in conjunction with KEFJ glacier mass balance field work but helicopter expenses were paid for by the I&M program. The station was in good shape but there was some rime ice attached to it (Figure 28). There were also a few snow machine tracks (Figure 28) and cigarette butts adjacent to the weather station. Some of the wind baffles on the precipitation gauge alter shield were upside down. These were repositioned. The AT-RH sensor, SR, WD sensor, and the WS sensor were replaced. Both wind sensors on this station are replaced each year because of the harsh conditions at the site. A WD sensor direction test was done. The SD sensor was replaced with a Judd Communications SD sensor that had been rehabbed with a new transducer plate and desiccant. The plastic pyramid on top of the old sensor came off as the old SD sensor was removed and will need to be glued back on using ‘liquid nails’ adhesive. All data were downloaded from the data logger to send to WRCC in order to update the archive. Data logger program HAIC_DLP_JUDD.prg was edited to zero the SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. The all-weather precipitation gauge was serviced by draining the antifreeze/alcohol/water solution and replacing it with a fresh solution. The tipping bucket was replaced, the rain count for the tipping bucket was zeroed, and a tipping bucket test was done. Lightweight hydraulic oil was poured on top of the antifreeze solution instead of regular motor oil. It is hoped that it will be less viscous during extremely cold periods and cause less snow bridging on top of the gauge. All bolts on the sensor arms and the tower and the guy-wires were tightened. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website by satellite phone. Before departure the station was photographed from eight directions (every 45°, Figure 29) and the inside of the instrument enclosure (Figure 30) was also photographed. Three new padlocks and WD-40 will be necessary during the next maintenance visit. It is also recommended that two Tyvek suits, two pairs of rubber gloves, a whole roll of paper towel,

and a large trash bag be brought the next time the gauge is serviced. A ball-valve assembly for the drain hose would also be useful to prevent spillage.

Figure 28. Harding Icefield RAWS – Rime ice was present on all the guy-wires and snow machine tracks are visible in the background.

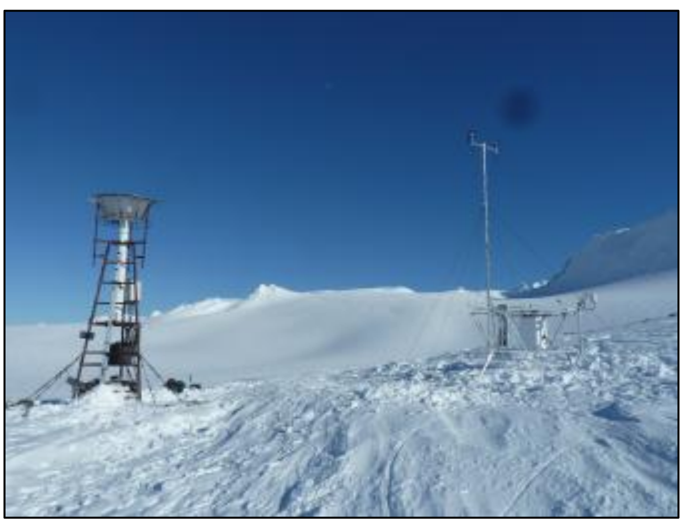

Figure 29. Harding Icefield RAWS – Station after maintenance viewed from the northwest.

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Figure 30. Harding Icefield RAWS – Inside of the instrument enclosure after maintenance. Note the wiring configuration used on the SDI-AM module.

Hickerson Lake Weather Station – Annual Maintenance – August 27, 2013

Date: August 27, 2013
Time of visit: 1100-1500
Personnel: Chuck Lindsay, Mary McBurney, Garth Murdock (Pathfinder Aviation)
Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)
Purpose of trip: Annual maintenance
Weather: Mostly cloudy, 58 F, winds SW 5 gusting to 15 mph

Sensors replaced:
Air temperature – relative humidity
Snow depth

Narrative:
An earlier attempt to access the weather station by float plane from Port Alsworth was thwarted by bad weather. Access to the Hickerson Lake weather station was by helicopter from Homer. The helicopter landed at the edge of the small wetland north of the weather station (Figure 31) and the remaining access was completed on foot (Figure 32). The station was in great shape. The AT-RH sensor was replaced and the SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which had been rehabbed with new transducer plates and desiccant. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. All data in the data logger were downloaded to send to the WRCC in order to update the archive. Data logger program HILA_DLP_SR50A.prg was edited to zero the SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. All bolts on the station were checked and tightened if loose and all cables were zip-tied. Before departure the station was photographed from eight directions (every 45°; Figure 33) and the inside of the instrument enclosure was also photographed (Figure 34).

Access to this station remains challenging and potentially unsafe. For this reason, an administrative decision (Lindsay 2013a, PEPC project number 46082) was made to relocate this weather station to Silver Salmon Lakes, approximately 10 miles to the northeast. The Hickerson Lake weather station will remain in operation until mid-summer 2014, when it will be decommissioned. The replacement weather station, called Silver Salmon Lakes, Alaska, was set up in July 2013.

When the Hickerson Lake weather station is removed it will probably make the most sense to sling the weather station to the ranger cabin at Chinitna Bay. It is not possible to land a helicopter at the weather station. The helicopter can land at the small wetland described above and personnel can hike to the weather station. The helicopter can then sling two empty cargo nets to the weather station site and return to pick up the sling nets and transport the station to Chinitna Bay.

Figure 31. Hickerson Lake RAWS – The helispot located at the small wetland north of the weather station.

Figure 32. Hickerson Lake RAWS – The hike from the helispot is challenging and takes about an hour. It should not be attempted when the ground is wet from rain.

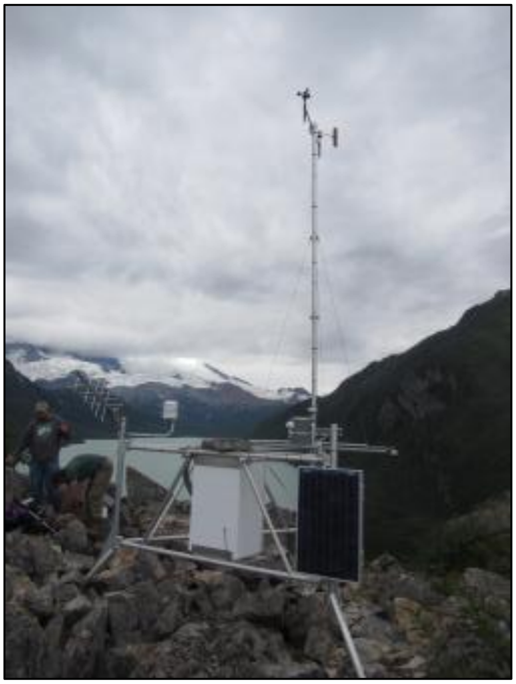

Figure 33. Hickerson Lake RAWS – The station after maintenance viewed from the southeast. Hickerson Lake and the flanks of Iliamna Volcano are visible in the background.

Figure 34. Hickerson Lake RAWS – The inside of the instrument enclosure after maintenance.

McArthur Pass Weather Station – Annual Maintenance – June 5, 2012

Date: June 10, 2013
Time of visit: 1100-1700
Personnel: Chuck Lindsay, Kris Holderied (NOAA)
Mode of transport: B206 helicopter from Homer (Pathfinder Aviation)
Purpose of trip: Annual maintenance
Weather: Sunny, 67 F, winds light from NW

Sensors replaced:
20 ft mast, wind sensor support arm, guy-wires
Air temperature – relative humidity
Wind speed and cable
Wind direction and cable
Rain gauge tipping bucket

Narrative:
A helicopter from Homer was used for access. The station was in fair condition – the solar panel, tipping bucket rain gauge, and wind speed sensor had issues. This solar panel should be replaced during the next maintenance visit because it has a small crack on the upper mounting bracket. The mast was replaced with a new one that had been reinforced by welding a smaller diameter aluminum pipe inside the mast (Figures 35 and 36) in order to reinforce the junction which has broken on three occasions in the past. All guy-wires and associated hardware were also replaced. The AT-RH sensor, WS sensor and cable, WD sensor and cable were replaced. The wind sensor had failed on March 7, 2013 because the bearing seized due to corrosion. Regardless, both wind sensors on this station are replaced each year because of the harsh conditions at the site. A WD sensor direction test was done. The tipping bucket mechanism had broken off inside the tipping bucket. This probably happened because of icing. As a result no precipitation was documented after December 12, 2012. The tipping bucket was replaced, the rain count for the tipping bucket was zeroed, and a tipping bucket test was done. The adjusting bolt on the tipping bucket mounting arm broke while leveling the gauge. In the future, a spare mount should be carried during every maintenance visit. All data in the data logger were downloaded to send to the WRCC in order to update the archive. Several elements on the GOES antenna were replaced because they had fallen out (Figure 37). This antenna uses the larger diameter elements and the whole antenna should be replaced during the next maintenance visit. All bolts on the station were checked and tightened if loose and all cables were zip-tied. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. Before departure the station was photographed from eight directions (every 45°, Figure 38) and the inside of the instrument enclosure (Figure 39) was also photographed.

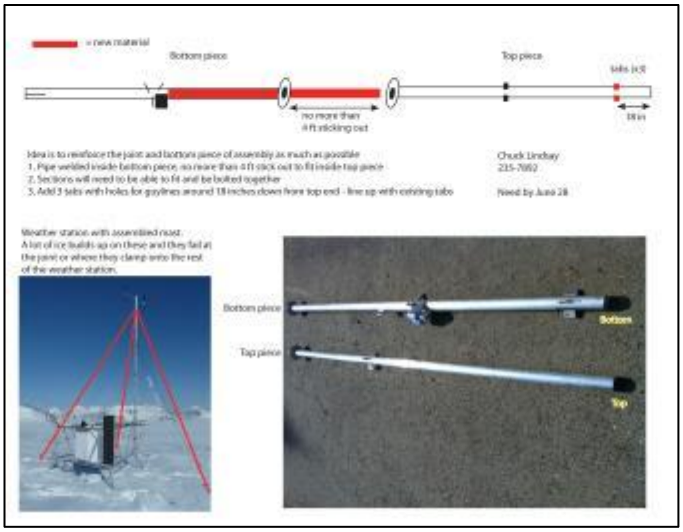

Figure 35. McArthur Pass RAWS – Description of custom modifications made to the 20 foot mast that supports the wind sensors.

Figure 36. McArthur Pass RAWS – Kris Holderied replacing the 20 foot mast that supports the wind sensors.

Figure 37. McArthur Pass RAWS – The newer-style FTS GOES antenna. Several of the antenna elements had fallen out. The NIFC RAWS Depot will not maintain this antenna model, claiming that it is 'disposable' – they prefer to maintain only the model with the smaller diameter antenna elements.

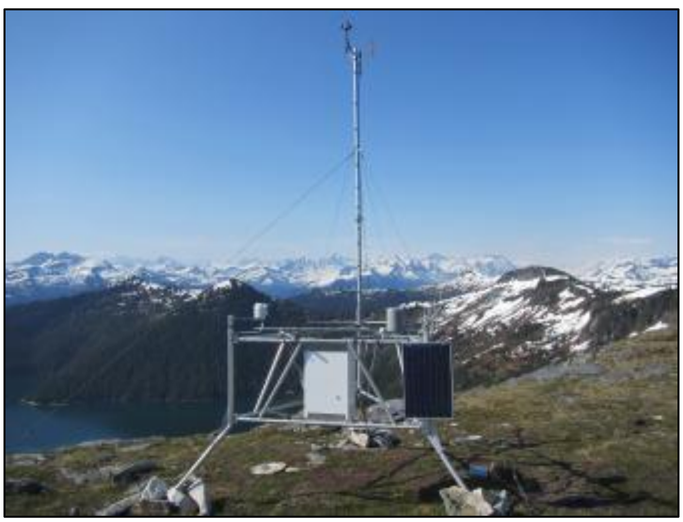

Figure 38. McArthur Pass RAWS – The station after maintenance viewed from the southeast.

Figure 39. McArthur Pass RAWS – Inside the instrument enclosure after maintenance.

Pedersen Lagoon Weather Station – Annual Maintenance – August 7, 2013

Date: August 7, 2013
Time of visit: 1400-1800
Personnel: Chuck Lindsay, Deborah Kurtz, Julie Markus
Mode of transport: M/V Serac
Purpose of trip: Annual maintenance
Weather: Rain, 54 F, winds light and variable

Sensors replaced:
Air temperature – relative humidity
Wind speed and cable
Wind direction and cable
Snow depth (Judd Communications sensor)

Narrative:
Access to the Pedersen Lagoon weather station was by M/V Serac (park boat from Seward) and foot (from Alaska Wildland Adventure's Kenai Fjords Glacier Lodge). It rained hard (Figure 40) with four inches of precipitation falling on the same day that maintenance was completed. Having an umbrella to cover notes, connections, and sensors was critical to successfully completing this maintenance trip. Vegetation beneath and around station had grown significantly (Figure 41) and was trimmed with hand tools. The ideal tools for this job seem to be garden shears and clippers. The weather station was in good shape with no significant damage. The AT-RH sensor, WS sensor, and WD sensors were all replaced. The WS sensor started acting up on June 19, 2013. An intermittent short circuit developed because of a break in the cable housing. This caused extra pulses to the data logger. As a result, artificially high peak wind speeds were reported between June 19 and August 7, 2013. Regardless of this issue, both wind sensors on this station are replaced each year because of harsh conditions at this site. Both wind sensor cables were also replaced. A WD sensor direction test was done. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. All data from the data logger were downloaded to send to the WRCC in order to update the data archive. The SD sensor was replaced with a Judd Communications SD sensor that had been rehabbed with a new transducer plate and desiccant. The data logger configuration file PELA_F6config_Judd.xml was uploaded in order to support the Judd Communications SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. All bolts on the station were checked and tightened if loose and cables were zip-tied. Station observations and GOES transmission quality were checked before departure. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. Before departure, the station was photographed from eight directions (every 45°; Figure 42) and the inside of the instrument enclosure (Figure 43) was also photographed.

Figure 40. Pedersen Lagoon RAWS – Maintenance was hampered by heavy rain, with four inches of precipitation on August 7, 2013.

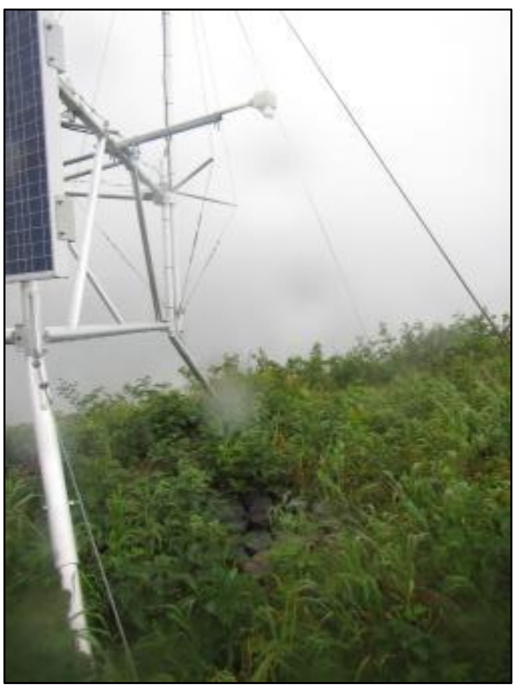

Figure 41. Pedersen Lagoon RAWS – Abundant vegetation grows around the weather station each summer. Plant growth is documented by the snow depth sensor which recorded a growth spurt beginning on June 19.

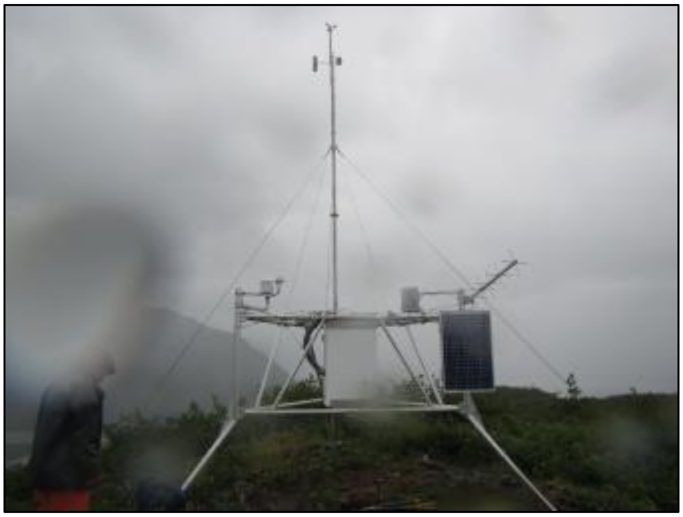

Figure 42. Pedersen Lagoon RAWS – Station after maintenance viewed from the south. Although difficult to see, vegetation beneath the station was trimmed.

Figure 43. Pedersen Lagoon RAWS – Inside of the instrument enclosure after maintenance.

Pfaff Mine Weather Station – Annual Maintenance – June 26, 2013

Date: June 26, 2013
Time of visit: 1300-1600
Personnel: Chuck Lindsay, Whitney Rapp
Mode of transport: C185 (on wheels) from King Salmon (park aircraft)
Purpose of trip: Annual maintenance
Weather: Sunny, 65 F, winds NW 10 mph gusting 20 mph

Sensors replaced:
Air temperature – relative humidity
Snow depth
Soil temperature probes
SDI analog module

Narrative:
Access to the Pfaff Mine weather station was by park wheel plane. The station was in fair shape – the AT-RH and soil temperature sensors were acting up. The second (50 cm) soil temperature sensor stopped working on July 11, 2012 - shortly after it was installed (soil temperature sensors are currently only installed at two stations but will be added to other stations where adequate soil depth is present in the future). Anomalous air temperature readings (e.g. 140 and -60 C) were present almost continuously from May 30, 2013 through the date of this maintenance visit and were unfortunately not resolved during this visit. The AT-RH sensor was replaced. The WS and WD sensor cables were replaced because they were showing signs of wear. A wind direction test was done. The rain count was zeroed, and a tipping bucket test was done. The SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which had been rehabbed with new transducer plates and desiccant. The dual soil temperature probes were replaced at the same location and depth of 10 and 50 cm (Figure 44). The SDI-AM module was also replaced (Figure 45). Data logger program PFMI_DLP_SR50A_SoilTemp.prg was edited to zero snow depth and operate the soil temperature sensors (transmitted element No. 17 corresponds to Temp1 in the data logger program and this is the soil temperature at 10 cm depth. Transmitted element No. 18 corresponds to Temp2 in the data logger program and this is the soil temperature at 50 cm depth). SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. All data were downloaded to send to WRCC in order to update the archive. Station observations and GOES transmission quality were checked before departure. Unfortunately, after the maintenance anomalous air temperature, snow depth, and battery voltage were still present. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. The diagnosis was that the data logger needed to be replaced, but a spare was not available. All bolts on the station were checked and tightened if loose and cables were zip-tied. Before departure the station was photographed from eight directions (every 45°, Figure 46) and the inside of the instrument enclosure (Figure 47) was also photographed.

Figure 44. Pfaff Mine RAWS – Vegetation mat replaced above the dual soil temperature sensors at 10 and 50 cm depth.

Figure 45. Pfaff Mine RAWS – Wiring configuration used on the analog/digital convertor to accommodate the dual soil temperature sensors.

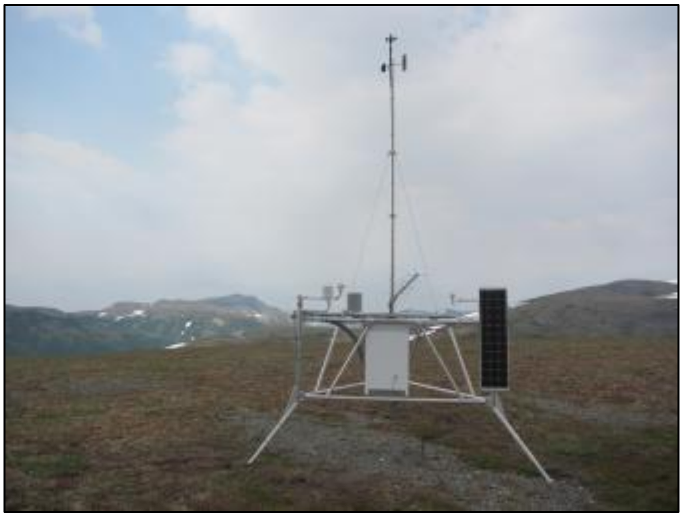

Figure 46. Pfaff Mine RAWS – Station after maintenance viewed from the south.

Figure 47. Pfaff Mine RAWS – Inside of instrument enclosure photographed just before departure.

Pfaff Mine Weather Station – Unscheduled Maintenance – July 22, 2013

Date: July 22, 2013
Time of visit: 1300-1500
Personnel: Chuck Lindsay, Leon Alsworth
Mode of transport: C185 (on wheels) from Homer (park aircraft)
Purpose of trip: Unscheduled maintenance
Weather: Sunny, 60 F, winds light and variable

Sensors replaced:
Air temperature – relative humidity
Data logger
GOES transmitter

Narrative:
Access to the Pfaff Mine weather station was by park (LACL) wheel plane from Homer on a trip heading to the Cook Inlet coast of Lake Clark. The station was in good shape except for the persistent issue (May 30 to July 22, 2013) that resulted in anomalous air temperature, snow depth, and battery voltage observations. Data logger program PFMI_DLP_SR50A_SoilTemp.prg was uploaded to a replacement data logger. Telemetry parameters were configured in a replacement GOES transmitter. The AT-RH sensor, data logger (12S version 6.6), and GOES transmitter (G5) were all replaced and the issue was resolved. It is likely that a faulty data logger motherboard was to blame. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. The inside of the instrument enclosure (Figure 48) was photographed before departure. Incidentally, a few caribou were seen running across the snowfields east of the weather station.

Figure 48. Pfaff Mine RAWS – Inside of instrument enclosure photographed just before departure.

Port Alsworth Phenocam – Annual Maintenance – June 21, 2013

Date: June 21, 2013
Time of visit: 1500-1900
Personnel: Chuck Lindsay
Mode of transport: Foot from Port Alsworth
Purpose of trip: Annual maintenance
Weather: Mostly cloudy, 63 F, winds light and variable

Sensors replaced:
Phenocam (Campbell Scientific) SD card and desiccant; removed battery and PV charge controller

Narrative:
The newer Campbell Scientific time lapse camera that is mounted to the Port Alsworth RAWS (Figure 49) was maintained. The 16 GB SD card was exchanged for an empty one and the tiny desiccant packs were replaced. The camera collected 13 JPG-format photos/day, but only between August 1, 2012 and September 14, 2013 when the camera apparently stopped working. Battery voltage was <2 V. It is assumed the camera did not switch into a low power state and therefore drained the battery. The 35 Ah battery and charge controller were removed and the camera was directly connected to a standard car battery with no solar panel input. Photographs do not seem to be of good quality (Figure 50). It is not expected to successfully operate for long in this configuration. Park staff will be requested to remove the camera and mail it back for examination by the manufacturer.

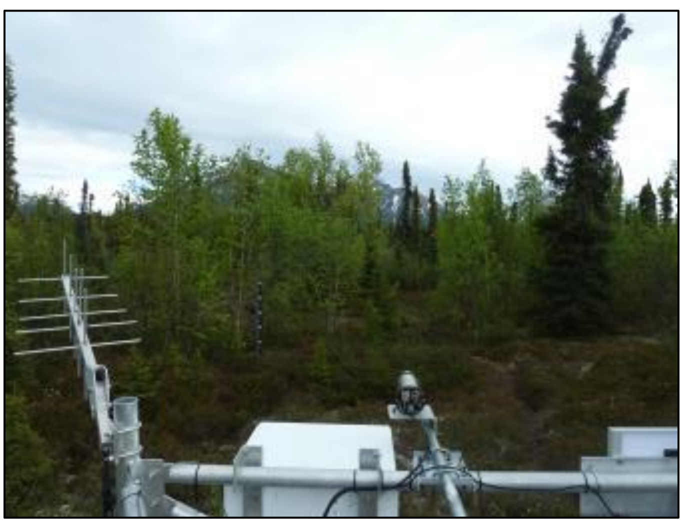

Figure 49. Port Alsworth phenocam – Campbell Scientific phenocam steup (center) and snow depth stake (background).

Figure 50. Port Alsworth phenocam – Time lapse photograph acquired on September 3, 2012.

Silver Salmon Lakes – Initial Station Setup – July 9, 2013

Date: July 9, 2013
Time of visit: 0900-1700
Personnel: Chuck Lindsay, Jared Irvine, Jeff Shearer, Cara Staab (BLM)
Mode of transport: M/V Chigmit (park boat) from Homer, ATV and foot from ranger cabin
Purpose of trip: Initial station setup
Weather: Sunny, 60 F, winds light and variable

Sensors installed:
Air temperature – relative humidity
Rain gauge tipping bucket
Wind speed
Wind direction
Solar radiation
Snow depth (Judd Communications)
Phenocam (Harbotronics)

Narrative:
This new weather station will eventually replace a weather station that was installed in 2008 at Hickerson Lake (located 10 miles to the southwest at a higher elevation). The Hickerson Lake weather station has proven difficult to access and an administrative decision (Lindsay 2013a, PEPC project number 46082) was made to relocate this weather station to Silver Salmon Lakes. The Hickerson Lake station will be removed in 2014 after both stations have operated for one year.

Transportation to the site was by park boat (Figure 51) from Homer and lodging was at the NPS ranger cabin at Silver Salmon Creek. The new weather station was set up in a meadow immediately south of the ranger cabin (Figure 52). Several small trees were cut adjacent to the station and any future seedlings that grow within a 60 foot radius of the weather station will need to be cut. An electric fence that incorporates solid wooden fence posts and a solar energizer was erected around the station (Figure 53). The station is equipped with the standard suite of AT-RH, RG-TB, WS, WS, and SR sensors. An analog/digital convertor (SDI-AM) was used to integrate a Judd Communications snow depth sensor. Data logger program SISA_DLP_F6_JUDD.xml was uploaded to the F6 data logger. SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. The inside of the instrument enclosure is shown in Figure 54.

A Harbortronics time lapse camera was mounted on the station (Figure 55). The field of view for the phenocam is shown in Figure 56. It is equipped with a 32 GB SD card and several desiccant packs. The camera intervalometer is programmed to collect six RAW-format photos/day between 10:00 and 15:00 AKDST. A thin film of silicone grease was applied to the gasket on the housing door with an irrigation syringe before closing the door in order to help maintain a seal.

Figure 51. Silver Salmon Lakes RAWS – The weather station was transported by boat from Homer to Silver Salmon Creek.

Figure 52. Silver Salmon Lakes RAWS – Station was set up in a meadow south of the ranger cabin.

Figure 53. Silver Salmon Lakes RAWS – Electric fence wiring. All wires are positive and connected to the energizer through the buried black wire.

Figure 54. Silver Salmon Lakes RAWS – Inside of the instrument enclosure.

Figure 55. Silver Salmon Lakes RAWS – Harbortronics phenocam enclosure.

Figure 56. Silver Salmon Lakes RAWS – Phenocam field of view (looking to the northwest).

Snipe Lake Weather Station – Annual Maintenance – June 20, 2013

Date: June 20, 2013
Time of visit: 1000-1500
Personnel: Chuck Lindsay, Tyler Lawson
Mode of transport: C185 (on floats) from Port Alsworth (park aircraft)
Purpose of trip: Annual maintenance
Weather: Mostly sunny, 60 F, winds SE 20 mph gusting 30 mph

Sensors replaced:
Air temperature – relative humidity
Snow depth (SR50A)
Phenocam (Harbotronics) SD card and desiccant
Phenocam (Campbell Scientific) SD card and desiccant; removed battery and PV charge controller

Narrative:
Access to the Snipe Lake weather station was by park float plane from Port Alsworth. The wind conditions (20 mph gusting 30 mph) upon arrival/departure were at the limit of what the park pilot was comfortable with for landing on Snipe Lake. The station was in good shape. The AT-RH sensor was replaced and the SD sensor was replaced with a Campbell Scientific SR50A SD sensor, which had been rehabbed with new transducer plates and desiccant. The rain count for the tipping bucket was zeroed and a tipping bucket test was done. All data in the data logger were downloaded to send to the WRCC in order to update the archive. Data logger program SNLA_DLP_SR50A.prg was edited to zero the SD sensor. Snow depth was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. Observations and transmissions were verified from the WFMI website and relayed by satellite phone. All bolts on the station were checked and tightened if loose and all cables were zip-tied. Before departure the station was photographed from eight directions (every 45°; Figure 57) and the inside of the instrument enclosure (Figure 58) was also photographed before departure.

The Harbortronics time lapse camera (Figure 59) was maintained. The 32 GB SD card was exchanged for an empty one and the desiccant packs were replaced. The camera collected five RAW-format photos/day between August 7, 2012 and June 20, 2013. The intervalometer programing was not changed. Before departure a thin film of silicone grease was applied to the gasket on the housing door with an irrigation to help maintain a seal.

The newer Campbell Scientific time lapse camera (Figure 60) was also maintained. The 16 GB SD card was exchanged for an empty one and the tiny desiccant packs were replaced. The camera collected 13 JPG-format photos/day between June 14, 2012 and December 20, 2012 when the camera apparently stopped working. Battery voltage was <2 V. It is assumed the camera did not switch into a low power state and therefore drained the battery during winter low-light conditions. The separate 35 Ah battery and charge controller were removed and the camera was directly connected to the two 100 Ah batteries that charge the weather station.

Figure 57. Snipe Lake RAWS – Station after maintenance (viewed from the northwest).

Figure 58. Snipe Lake RAWS – Inside of instrument enclosure after maintenance. Note Campbell Scientific power cable with white labeling leading toward 100 Ah batteries.

Figure 59. Snipe Lake RAWS – Harbortronics phenocam.

Figure 60. Snipe Lake RAWS – Campbell Scientific phenocam.

Three Forks – Initial Station Setup – September 5, 2013

Date: September 5, 2013
Time of visit: 0900-1500
Personnel: Chuck Lindsay, Bob Peterson
Mode of transport: Found Bush Hawk (on floats) from King Salmon (USFWS aircraft), vehicle from Brooks Camp to Three Forks
Purpose of trip: Initial station setup
Weather: Cloudy, 48 F, winds SE 15 mph

Sensors installed:
Air temperature – relative humidity
Rain gauge tipping bucket
Wind speed
Wind direction
Solar radiation
Snow depth

Narrative:
This new weather station replaces a weather station that was installed in 2008 at Contact Creek (located 25 miles to the southwest). The NOAA installed a Climate Reference Network (CRN) station at Contact Creek in August 2012. As planned, both the CRN station and the Contact Creek RAWS overlapped in operation for one year. An administrative decision was made by the park and SWAN (Lindsay 2013b) to move the weather station to Three Forks near the Valley of Ten Thousand Smokes. The Contact Creek RAWS was disassembled and packaged for transport to Three Forks (25 miles to the northeast). Egli Air Haul slung the weather station frame, instrument enclosure and batteries to Three Forks and the remaining components were taken to King Salmon and then Brooks Camp aboard fixed-wing aircraft. Although the new station (called Three Forks, Alaska) uses the same equipment and NESDIS ID number as the Contact Creek RAWS, it is considered a new station and will receive a new NWS location identifier and new station pages on the internet.

The new weather station was set up on the hill slope immediately southwest of the NPS cabin at Three Forks (Figure 61). The station is equipped with the standard suite of AT-RH, RG-TB, WS, WS, SR, and SD sensors (Figure 62). Data logger program THFO_DLP_SR50A.prg was uploaded to the 12S data logger. SD was zeroed to an average reading of -0.5 inches to account for fluctuation without reporting misleading snow depth readings. The inside of the instrument enclosure is shown in Figure 63. The station was camouflaged using spray paint (Figure 62). The station was anchored to the ground using two three foot long steel stakes driven through the tower feet. It is recommended that additional anchors (guy-wires and duckbill anchors) be installed in the future.

Figure 61. Three Forks RAWS – The weather station (circled) is visible to the left of the Three Forks cabin.

Figure 62. Three Forks RAWS – The weather station after set up (viewed from the southwest). The station, with the exception of the sensors, was camouflaged using spray paint.

Figure 63. Three Forks RAWS – Inside of the instrument enclosure after set up.

Weather Station Sensor Metadata

Table 2. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height m	Serial no	Asset no	Start date	Stop date
Chigmit Mountains	AT-RH	FTS THS-3	2.34	49794	39340	6/11/12	6/12/13
	AT-RH	FTS THS-3	2.34	31672	22269	6/12/13	active
	WD	FTS 023-30	6.10	K4017	104913	6/11/12	6/12/13
	WD	FTS 023-30	6.10	415511	40441	6/12/13	active
	WS	FTS 013-30	6.10	36907	30587	6/11/12	6/12/13
	WS	FTS 013-30	6.10	47792	41774	6/12/13	active
	RG-TB	FTS RG-T	2.18	2754	121530	6/11/12	active
	SR	FTS SDI-SR-PYR	2.29	14519	7029	6/30/11	active
	SD	CS SR50A	1.87	88116	n/a	6/11/12	6/12/13
	SD	CS SR50	1.87	8118	n/a	6/12/13	active
Contact Creek	AT-RH	FTS THS-3	2.21	32359	22126	6/21/12	6/24/13
	AT-RH	FTS THS-3	2.21	42108	39215	6/24/13	9/03/13
	WD	FTS 023-30	2.34	J7032	30305	6/21/12	9/03/13
	WS	FTS 013-30	6.10	K1530	125507	6/21/12	9/03/13
	RG-TB	FTS RG-T	2.26	93217	19574	6/14/11	9/03/13
	SR	FTS SDI-SR-PYR	2.29	18427	7734	6/14/11	9/03/13
	SD	CS SR50A	1.80	28268	n/a	6/21/12	6/24/13
	SD	CS SR50A	1.80	41910	n/a	6/24/13	9/03/13
Coville	AT-RH	FTS THS-3	2.06	27667	127814	6/20/12	6/25/13
	AT-RH	FTS THS-3	2.06	26745	106015	6/25/13	active
	WD	FTS 023-30	6.10	37246	39665	6/20/12	active
	WS	FTS 013-30	6.10	37241	107508	6/20/12	active
	RG-TB	FTS RG-T	2.21	1596	6808	6/14/11	active
	SR	FTS SDI-SR-PYR	2.21	26378	127804	6/14/11	6/25/13
	SR	FTS SDI-SR-PYR	2.21	PYR112	4049	6/25/13	active
	SD	CS SR50	1.52	18259	n/a	6/20/12	6/25/13
	SD	CS SR50A	1.52	3341	n/a	6/25/13	active

Table 2 continued. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height m	Serial no	Asset no	Start date	Stop date
Fourpeaked	AT-RH	FTS THS-3	2.34	51288	39788	6/7/12	6/12/13
	AT-RH	FTS THS-3	2.34	30638	16584	6/12/13	active
	WD	FTS THS-3	6.10	30181	13517	6/7/12	6/12/13
	WD	FTS THS-3	6.10	40928	41252	6/12/13	active
	WS	FTS 023-30	6.10	Y4728	15990	6/7/12	6/12/13
	WS	FTS 013-30	6.10	18177	124921	6/12/13	active
	RG-TB	FTS RG-T	2.18	97206	121220	6/30/11	active
	SR	FTS SDI-SR-PYR	2.29	3993	110789	10/22/12	active
	SD	removed	n/a	n/a	n/a	6/7/12	n/a
Harding Icefield	AT-RH	FTS THS-3		4791	39337	4/25/12	4/19/13
	AT-RH	FTS THS-3		31560	30469	4/19/13	active
	WD	FTS 013-30	6.10	43702	13664	4/25/12	4/19/13
	WD	FTS 013-30	6.10	17534	125725	4/19/13	active
	WS	FTS 023-30	6.10	32004	39198	4/25/12	4/19/13
	WS	FTS 023-30	6.10	6236	40209	4/19/13	active
	RG-TB	FTS RG-T		20173	122373	5/2/11	4/19/13
	RG-TB	FTS RG-T		5075	118331	4/19/13	active
	SR	FTS SDI-SR-PYR		36485	30140	4/24/10	4/19/13
	SR	FTS SDI-SR-PYR		1253	119897	4/19/13	active
	SD	Judd	1.74	3690	n/a	4/25/12	4/19/13
	SD	Judd	1.74	4070	n/a	4/19/13	active
Hickerson Lake	AT-RH	FTS THS-3	2.49	51283	39783	6/16/12	8/27/13
	AT-RH	FTS THS-3	2.49	28820	6848	8/27/13	active
	WD	FTS 013-30	6.10	7145	125325	6/16/12	active
	WS	FTS 023-30	6.10	N1501	105962	6/16/12	active
	RG-TB	FTS RG-T	2.46	1686	117213	7/7/11	active
	SR	FTS SDI-SR-PYR	2.54	22383	126817	7/7/11	active
	SD	CS SR50	1.65	15070	n/a	6/16/12	8/27/13
	SD	CS SR50A	1.65	41908	n/a	8/27/13	active

Table 2 continued. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height m	Serial no	Asset no	Start date	Stop date
McArthur Pass	AT-RH	FTS THS-3	2.24	49963	39760	6/5/12	6/10/13
	AT-RH	FTS THS-3	2.24	28502	6637	6/10/13	active
	WD	FTS THS-3	6.10	22940	35935	6/5/12	6/10/13
	WD	FTS THS-3	6.10	42051	41296	6/10/13	active
	WS	FTS 023-30	6.10	Y4726	39218	6/5/12	6/10/13
	WS	FTS 013-30	6.10	41222	40431	6/10/13	active
	RG-TB	FTS RG-T	2.39	41334	36331	6/5/12	6/10/13
	RG-TB	FTS RG-T	2.39	26116	42059	6/10/13	active
	SR	FTS SDI-SR-PYR	2.39	50530	39525	6/5/12	active
	SD	removed	n/a	n/a	n/a	6/5/12	n/a
Pedersen Lagoon	AT-RH	FTS THS-3	2.14	22737	39093	7/25/12	8/7/13
	AT-RH	FTS THS-3	2.14	31565	30474	8/7/13	active
	WD	FTS 013-30	6.03	J7089	30318	7/25/12	8/7/13
	WD	FTS 013-30	6.03	42052	41298	8/7/13	active
	WS	FTS 023-30	6.03	22737	39093	7/25/12	8/7/13
	WS	FTS 023-30	6.03	B3090	1354	8/7/13	active
	RG-TB	FTS RG-T	1.91	40718	n/a	8/10/11	active
	SR	FTS SDI-SR-PYR	2.21	39327	n/a	8/10/11	active
	SD	Judd	1.71	04015	n/a	7/25/12	8/7/13
	SD	Judd	1.71	3690	n/a	8/7/13	active
Pfaff Mine	AT-RH	FTS THS-3	2.03	51274	39775	6/21/12	6/26/13
	AT-RH	FTS THS-3	2.03	30819	22217	6/26/13	7/22/13
	AT-RH	FTS THS-3	2.03	28824	7148	7/22/13	active
	WD	FTS 013-30	6.10	39942	39532	6/21/12	active
	WS	FTS 023-30	6.10	34209	39551	6/21/12	active
	RG-TB	FTS RG-T	2.21	unknown	37579	6/21/12	active
	SR	FTS SDI-SR-PYR	2.21	19009	102143	6/15/11	active
	SD	CS SR50A	1.51	42006	n/a	6/21/12	6/26/13
	SD	CS SR50A	1.51	41916	n/a	6/26/13	active

Table 2 continued. Sensor metadata for weather stations operated and maintained by the SWAN.

Station name	Sensor	Model	Height m	Serial no	Asset no	Start date	Stop date
Silver Salmon Lakes	AT-RH	FTS THS-3	2.27	54810	n/a	7/9/13	active
	WD	FTS 013-30	6.36	32054	n/a	7/9/13	active
	WS	FTS 023-30	6.36	55017	n/a	7/9/13	active
	RG-TB	FTS RG-T	2.36	40720	n/a	7/9/13	active
	SR	FTS SDI-SR-PYR	2.36	39705	n/a	7/9/13	active
	SD	Judd	2.03	4417	n/a	7/9/13	active
Snipe Lake	AT-RH	FTS THS-3	2.16	51287	39787	6/14/12	6/20/13
	AT-RH	FTS THS-3	2.16	32419	22096	6/20/13	active
	WD	FTS 013-30	6.10	7147	125837	6/14/12	active
	WS	FTS 023-30	6.10	36480	124605	6/14/12	active
	RG-TB	FTS RG-T	2.26	26640	127456	6/17/11	active
	SR	FTS SDI-SR-PYR	2.21	15340	122043	6/17/11	active
	SD	CS SR50A	2.11	28267	n/a	6/14/12	6/20/13
	SD	CS SR50A	2.11	41914	n/a	6/20/13	active
Three Forks	AT-RH	FTS THS-3	2.24	42108	39215	9/5/13	active
	WD	FTS 013-30	6.28	J7032	30305	9/5/13	active
	WS	FTS 023-30	6.28	K1530	125507	9/5/13	active
	RG-TB	FTS RG-T	2.01	93-217	19574	9/5/13	active
	SR	FTS SDI-SR-PYR	2.30	18427	7734	9/5/13	active
	SD	CS SR50A	1.91	41910	n/a	9/5/13	active

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